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Edited by
Andrea Stupňanová, Martin Dyba, Viktor Pavliska



UNIVERSITY OF OSTRAVA
INSTITUTE FOR RESEARCH
AND APPLICATIONS
OF FUZZY MODELING

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SLOVAK UNIVERSITY OF
TECHNOLOGY IN BRATISLAVA

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Department of Mathematics and Descriptive Geometry,
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$\{M, L, TL, T, \dots\}$ denotes the specific moment class. The corresponding variance is defined as $U\text{-VAR}[X](\theta) := e_2^U(\theta) - (e_1^U(\theta))^2$. We show that, under suitable choices of the distortion function, Choquet moments can encompass each of these alternative moment types. In particular, the relationship between standard fuzzy variance and the newly defined $U\text{-VAR}$ variance provides new insight into moment and variance estimation in non-additive settings.

The Choquet integral quadruplet framework clarifies relationships between moment types, supports generalization beyond classical assumptions, and enhances the interpretability of robust statistical measures. This contribution focuses on these theoretical foundations and demonstrates the unifying potential of Choquet-based moments through selected examples and comparisons.

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Towards a Solver-Free Best-Worst Method

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Multi-criteria decision-making methods such as Saaty Analytic Hierarchy Process, Thurstone Method, and the Best-Worst Method are widely recognised tools for deriving criteria weights [4], [3], [1]. Although effective, some of these methods require solving optimisation problems, which increases computational effort and limits their wider applicability.

This contribution introduces an extension of the classical Best-Worst Method that simplifies the weighting process. Instead of solving an optimisation task, weights $w_i, i = 1, 2, \dots, n$, are derived solely by assigning integer values from 1 to 9 to the others-to-the-worst indicator. They are then calculated directly according to the formula

$$w_i = \frac{f(x_i) \times x_i}{\sum_{i=1}^n f(x_i) \times x_i}.$$

For increasing functions f , the weights are consistent by construction, while in the case of decreasing functions, sufficient conditions must be satisfied to guarantee monotonicity and consistency.

The main advantage of this approach lies in its simplicity and efficiency. It eliminates the need for solvers and objective function evaluation, making it suitable for applications with many criteria or for evaluators lacking optimisation expertise. The proposed extension thus represents a practical and robust alternative that combines methodological soundness with usability and can be applied, for example, in the assessment of pension system sustainability [2].

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On aggregation of Ω -groups and fuzzy subgroups

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In classical algebraic systems, the family of all substructures of a structure is closed under intersection, while unions preserve the given structure only in certain cases. For example, the union of two subgroups is a subgroup if and only if one of them is contained in the other one. A similar problem appears in fuzzy settings, where the aggregation of two fuzzy subgroups seldom results in a fuzzy subgroup. Some exceptions in a few specific situations are described in [1,4,2]. Motivated by these limitations, aggregation processes in specific type of lattice-valued algebraic structures are investigated. The focus of this paper is on Ω -groups, where Ω is a complete distributive lattice ([5]).

Both the aggregation of equivalence relations compatible with the algebraic structure and the aggregation of fuzzy groups are investigated, using a lattice-valued approach with the minimum T -norm and the cut-based interpretation. The problem is observed in reverse: instead of constructing an aggregation directly, the resulting Ω -group that should represent the aggregate of two given Ω -groups is first identified, and then the conditions under which an aggregation operator can produce such a structure are analyzed. The structural properties of Ω -groups are characterized, and the preservation of these properties under aggregation is studied. Particular emphasis is placed on possibility of using discrete fuzzy integrals as aggregation operators for this type of problem. Since the approach is lattice-valued, the assumption is that the aggregation

operators are compatible with the lattice structure [3].

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The Application of the Choquet integral in Fuzzy Cognitive Maps

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